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EXAMINER	
CREPEAU, JONATHAN	
ART UNIT	**PAPER NUMBER**
1746	9

DATE MAILED: 07/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application N .	Applicant(s)	
	09/858,327	OHLSEN ET AL.	
	Examiner	Art Unit	
	Jonathan S. Crepeau	1746	

-- The MAILING DATE of this communication appears on the cover she t with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 May 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8-13,15-25,27-32 and 34-40* is/are rejected.

7)☒ Claim(s) *7,14,26 and 33* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

1. This Office action addresses claims 1-40. Claims 7, 14, 26 and 33 remain objected to as containing allowable subject matter. Claims 1-6, 8-13, 15-25, 27-32, and 34-40 remain rejected for substantially the reasons of record. Accordingly, this action is made final.

Terminal Disclaimer

2. The terminal disclaimer filed on May 5, 2003 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. application serial no. 09/715,830 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Claim Rejections - 35 USC § 103

3. Claims 17, 18, 23-25, 27-32, and 34-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over FR 2667728 in view of DE 19820756 and Wilkinson et al (U.S. Patent 5,874,182).

Regarding claims 17 and 40, the French reference is generally directed to a fuel cell system comprising an electrode assembly (see abstract; Figure 1). The assembly comprises an anode, cathode and electrolyte (3, 9). The central portion of the electrolyte (3) functions as a spacing structure. Regarding claims 27, 28, 34, 35, and 40, each electrode comprises a plurality of pores (7) having catalyst particles (8) noncontiguously dispersed thereon (see Fig. 1).

Regarding claims 29 and 36, the anode and cathode catalysts are derived from a metal, particularly platinum (see page 5, first full paragraph of translation). Regarding claims 17, 37, 39, and 40, the central portion of the electrolyte (3) contains a liquid such as phosphoric or sulfuric acid (see page 4, second-to-last paragraph of the translation). Regarding claim 40, a polymeric electrolyte (9) is uniformly deposited on the inner pore surfaces (see page 5, first full paragraph).

The French reference does not expressly tech that the electrodes are derived from planar silicon substrates (claims 17 and 18), or that the electrodes each have a plurality of discrete porous regions (claims 24, 25, 31, and 32). The reference also does not teach a plurality of integral flow channels in each electrode (claims 23 and 30), or that the fuel cell is a liquid feed fuel cell having an aqueous organic fuel (e.g., methanol) flows through the anode and central portion of the electrolyte (claims 17, 37, 38, and 40). The reference further does not teach that the anode catalyst particles are derived from platinum and ruthenium precursors (claim 29) or that both catalysts are chemisorbed (claims 28, 29, 35, and 36).

The DE '756 publication is directed to perforated silicon workpieces that may be used as electrodes (i.e., catalyst supports) in fuel cells (see abstract). The workpiece comprises pores (channels) that are formed by etching. The workpiece also has a plurality of discrete regions (6) containing the pores (4) (see Figs. 4 and 5). Regarding claims 25 and 32, the pores have a diameter of 2 microns, thereby rendering the workpiece macroporous (based on an oral translation of col. 3, line 21).

The patent of Wilkinson et al. is directed to a method and apparatus for reducing reactant crossover in a fuel cell (see abstract). In column 8, line 21, the reference teaches that methanol

may be supplied to the anode in an aqueous acid solution. In column 8, line 38, the reference discloses an anode catalyst composition of carbon-supported platinum and ruthenium.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to use the perforated silicon workpiece of the German reference as the anode and cathode catalyst supporting structures of the French reference. In the abstract, the German reference teaches that "the incompletely perforated second regions provide the perforated workpiece with increased strength and stability in an inexpensive manner, so that the risk of breakage during mounting is reduced." Accordingly, the artisan would be motivated by this disclosure to use the workpiece of the German reference as the catalyst supporting structure in the electrodes of the French reference.

Additionally, the disclosure of Wilkinson et al. would motivate the artisan to feed an aqueous methanol/acid solution to the anode, and thereby to the electrolyte, of the French reference. In column 2, line 15, Wilkinson et al. teach that such an aqueous solution "is the preferred feed" to the anode. Accordingly, the artisan would be motivated to feed an aqueous methanol/acid solution to the anode, and thus to the electrolyte, of the French reference.

Regarding the catalyst composition recited in claim 29, Wilkinson et al. teach in column 8, line 26 that "any catalyst which is effective for the oxidation of methanol may be employed in the anode of a direct methanol fuel cell." Since Example 1 of Wilkinson et al. employs a Pt-Ru catalyst, the artisan would be reasonably apprised of the suitability of this composition for use as the catalyst of the French reference. Accordingly, this limitation is not considered to distinguish over the references.

Regarding the limitations in claims 28, 29, 35, and 36 that the catalysts are chemisorbed onto the pore surfaces, these limitations do not have to be accorded patentable weight because they do not limit the structure of the electrode. Generally, process limitations in product or apparatus claims are not accorded weight because they do not structurally limit the product or apparatus (MPEP §2113).

4. Claims 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over FR 2667728 in view of DE 19820756 in view of Wilkinson et al. as applied to claims 17, 18, 23-25, 27-32, and 34-40 above, and further in view of WO 98/21777.

The French reference does not expressly teach the presence of a blocking media that is substantially impermeable to methanol but substantially permeable to hydrogen atoms interposed between the anode and cathode (claim 19). The reference further does not teach that the blocking media is integrally connected to the cathode (claim 20), that it comprises a metallic membrane (claim 21), or that it comprises Pd, Nb, Ta, or V (claim 22).

WO 98/21777 is directed to a fuel cell comprising a methanol blocking media (5) interposed between an anode (3) and a cathode (7) (see abstract; Fig. 1). The blocking media is integrally connected to the cathode via the electrolyte (6), and comprises a metallic membrane such as a palladium alloy.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the disclosure of the WO '777 reference would motivate the artisan to include such a blocking layer in the fuel cell of the French

reference. In the abstract, the WO '777 reference teaches that the blocking layer is suitable in fuel cells using methanol as a fuel. Accordingly, the artisan would be motivated to include such a blocking layer in the fuel cell of the French reference, since as noted above, the artisan would also be motivated to use methanol as the fuel of the French reference.

5. Claims 1-6, 8-13, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over FR 2667728 in view of DE 19820756 in view of Wilkinson et al. as applied to claims 17, 18, 23-25, 27-32 and 34-40 above, and further in view of Mercuri et al (U.S. Patent 6,413,671).

Regarding claims 1, 8, and 15, DE '756 further teaches in Figures 4 and 5 that one side of the silicon substrate comprises channels (6) which connect a plurality of acicular pores (4). However, DE '756 does not expressly teach that the other side of the substrate comprises channels such that the pores are in fluid communication with channels on both sides of the substrate, as recited in claims 1, 8, and 15.

The patent of Mercuri et al. is directed to graphite electrodes for fuel cells. In Figures 3, 6, and 7, the reference teaches channels (5) on the surface of the electrode facing the electrolyte that are in fluid communication with linear acicular pores (20).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated by the disclosure of Mercuri et al. to incorporate fluid removal channels on the side of the substrate of DE '756 opposite the side already containing the channels 6. It should first be noted that upon incorporating the substrate of DE '756 into the fuel cell of the French reference, the artisan

would be motivated to use the top surface (2) of the substrate as the surface facing the electrolyte since it has more catalytic surface area (i.e., more open pores). Accordingly, in this configuration, the channels 6 on the substrate would be located on the outside of the electrode. As noted above, Mercuri et al. teach fluid removal passages (5) in the inside surfaces of electrodes. In column 7, line 9, Mercuri et al. teach that "in the event of a blockage in a channel 20, such as indicated at 7 in FIGS. 6 and 7, fluid from adjacent channels can flow through grooves 5 so that gas-catalyst contact adjacent the blocked channel is maintained." Accordingly, this would provide sufficient motivation to incorporate channels onto the inside surface of the electrodes of the French reference, corresponding to the top surface of the substrates of DE '756.

6. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over FR 2667728 in view of DE 19820756 in view of Wilkinson et al. in view of Mercuri et al. as applied to claims 1-6, 8-13, and 15 above, and further in view of Okamoto (U.S. Patent 5,723,228).

None of the applied references expressly teaches a fuel cell stack comprising a first end cap assembly having a first fluid inlet port and a second fluid outlet port, and a second end cap assembly having a third fluid inlet port and a fourth fluid outlet port.

The patent of Okamoto et al. is directed to a fuel cell stack having end plates (22a,b; see Fig. 3). As shown in Fig. 3, end plate 22a has a first inlet for fuel (i.e., methanol and water) and a second outlet for fuel, and end plate 22b has a third inlet for air and a fourth outlet for air.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to use the fuel

cell stack and end plate structure of Okamoto et al. in constructing the fuel cell stacks containing the claimed electrode assemblies. In column 2, line 7, Okamoto et al. teach that "[a]ccordingly, the aqueous methanol solution as fuel flows through a fuel cell unit in the direction opposite to the direction in which the oxygen containing gas flows. Therefore, it is possible to minimize the ununiform temperature distribution in the fuel cell unit as less as possible. Thus, it is possible to obtain a stable output voltage from the fuel cell unit." Accordingly, the artisan would be motivated to use the fuel cell stack and end plate structure of Okamoto et al. in constructing the fuel cell stacks containing the claimed electrode assemblies.

Response to Arguments

7. Applicant's arguments filed May 5, 2003 have been fully considered but they are not persuasive. Applicants assert that the silicon workpieces of the German reference "are not capable of functioning satisfactorily as fuel cell electrode structures" based on their stated resistivity of 5 Ω cm. However, while the workpieces may not meet Applicants' performance specifications when used in a fuel cell, the fact that the abstract of DE '756 discloses that the workpiece can be used in a "battery or fuel cell electrode" is sufficient guidance for an artisan to use them in such a capacity. The "satisfactory" performance of the current collectors is a subjective standard that varies between skilled artisans. Accordingly, Applicant's assertion that the workpieces cannot function "satisfactorily" as current collectors in a fuel cell is not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a resistivity of 0.05 Ω cm) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicants further assert that "because the prior art invention being modified (i.e., fuel cell of FR 2667728) would result in an inoperative device (thus unsatisfactory for its intended purpose), there can be no suggestion or motivation to make the Examiner's proposed modifications." In response, it is submitted that there is no evidence that the proposed modification would render the fuel cell of the French reference "inoperative." As noted above, Applicants have, through their research, defined a threshold resistivity value which they believe results in good fuel cell performance. However, another person of skill in the art might have a lower threshold of fuel cell performance, and thus would not be as concerned with the resistivity of the silicon substrate of DE '756. As stated above, the teachings of the DE '756 reference regarding the high strength and stability of the workpiece would motivate the artisan to make the proposed modification. In any event, there is no evidence that the use of the substrate of DE '756 in the fuel cell of the French reference would render the fuel cell "inoperable."

Applicants further assert that "those of ordinary skill in the art would find no motivation whatsoever to deliver a liquid methanol/acid solution to the anode of the FR 2667728. In large part, this is because the fuel cell design disclosed by FR 2667728 is expressly limited to a non-liquid feed hydrogen-oxygen type of fuel cell." In response, while it is acknowledged that the FR reference "concerns" hydrogen-oxygen fuel cells (see page 2 of translation), it is submitted

that the reference is not "expressly limited" to such fuel cells. To the contrary, it is the Examiner's position that a person of skill in the art understands that many direct methanol fuel cells are structurally identical, or structurally similar to corresponding fuel cells using a gaseous hydrogen reactant, and that a teaching regarding one type of fuel cell is generally applicable to the other type. Accordingly, it is still believed that the application of the teachings of Wilkinson to the fuel cell of the French reference is proper.

Applicants further assert that the Examiner's arguments for combining the teachings of Mercuri and the DE '756 reference to the FR reference are "incongruent" because the stated motivation of "more contact area" of DE '756 would be defeated by the subsequent creation of channels in the surface of the electrode of DE '756. While the Examiner generally agrees with this assertion, there is still believed to be sufficient motivation to combine the references in a manner that produces the claimed invention. As stated in the rejection above, upon incorporating the substrate of DE '756 into the fuel cell of the French reference, the artisan would be motivated to use the top surface (2) of the substrate as the surface facing the electrolyte since it has more catalytic surface area (i.e., more open pores). The subsequent inclusion of channels in this surface as suggested by Mercuri et al. would not decrease the number of pores in the surface. Accordingly, there is still believed to be proper motivation for combining Mercuri et al., DE '756 and the French reference.

Allowable Subject Matter

8. Claims 7, 14, 26 and 33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. The following is an examiner's statement of reasons for allowance:

The reasons for allowance of the instant claims were given in the previous Office action and remain applicable herein.

Conclusion

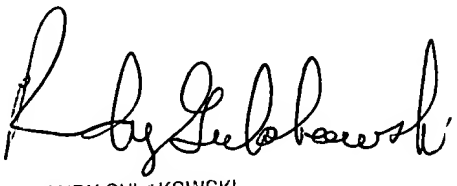
10. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Crepeau whose telephone number is (703) 305-0051. The examiner can normally be reached Monday-Friday from 9:30 AM - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski, can be reached at (703) 308-4333. The phone number for the organization where this application or proceeding is assigned is (703) 305-5900. Additionally, documents may be faxed to (703) 872-9310 (for non-final communications) or (703) 872-9311 (for after-final communications).

Any inquiry of general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



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July 15, 2003